This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Simplify the expression below and choose the interval the simplification is contained within.

$$5 - 6 \div 16 * 19 - (4 * 18)$$

The solution is -74.125, which is option C.

A. $[-114.25, -107.25]$

-110.250, which corresponds to not distributing a negative correctly.

B. $[76.98, 80.98]$

76.980, which corresponds to not distributing addition and subtraction correctly.

C. $[-78.12, -69.12]$

* -74.125, which is the correct option.

D. $[-69.02, -64.02]$

-67.020, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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2. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{144}{49}}$$

The solution is Rational, which is option D.

A. Irrational

These cannot be written as a fraction of Integers.

B. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

C. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

D. Rational

* This is the correct option!

E. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\frac{12}{7}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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3. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{840}{14}}$$

The solution is Irrational, which is option B.

A. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

B. Irrational

* This is the correct option!

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

D. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

E. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{60}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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4. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{\sqrt{143}}{6} + \sqrt{-4}i$$

The solution is Irrational, which is option B.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

B. Irrational

* This is the correct option!

C. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

D. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

E. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(7 + 3i)(-4 + 2i)$$

The solution is $-34 + 2i$, which is option A.

A. $a \in [-35, -33.3]$ and $b \in [0.3, 2.6]$

* $-34 + 2i$, which is the correct option.

B. $a \in [-35, -33.3]$ and $b \in [-2.4, 1.6]$

$-34 - 2i$, which corresponds to adding a minus sign in both terms.

C. $a \in [-24.9, -18.6]$ and $b \in [-26.5, -22.1]$

$-22 - 26i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-32, -27.2]$ and $b \in [5.6, 8.2]$

$-28 + 6i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

E. $a \in [-24.9, -18.6]$ and $b \in [24.6, 26.8]$

$-22 + 26i$, which corresponds to adding a minus sign in the first term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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6. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{27 - 44i}{-5 + 8i}$$

The solution is $-5.47 + 0.04i$, which is option E.

A. $a \in [-487.16, -486.97]$ and $b \in [0, 0.7]$

$-487.00 + 0.04i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [2.33, 2.62]$ and $b \in [4.55, 5.45]$

$2.44 + 4.90i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-5.45, -5.34]$ and $b \in [-5.55, -5.15]$

$-5.40 - 5.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [-5.51, -5.42]$ and $b \in [3.95, 4.45]$

$-5.47 + 4.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-5.51, -5.42]$ and $b \in [0, 0.7]$

* $-5.47 + 0.04i$, which is the correct option.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-3 + 8i)(2 - 6i)$$

The solution is $42 + 34i$, which is option C.

A. $a \in [-7, -2]$ and $b \in [-48.7, -45.3]$

$-6 - 48i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

B. $a \in [-57, -50]$ and $b \in [-2.8, -1.7]$

$-54 - 2i$, which corresponds to adding a minus sign in the second term.

C. $a \in [33, 47]$ and $b \in [31.5, 36.6]$

* $42 + 34i$, which is the correct option.

D. $a \in [-57, -50]$ and $b \in [-0.9, 2.4]$

$-54 + 2i$, which corresponds to adding a minus sign in the first term.

E. $a \in [33, 47]$ and $b \in [-35.5, -30.9]$

$42 - 34i$, which corresponds to adding a minus sign in both terms.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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8. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{9 + 66i}{-8 - 3i}$$

The solution is $-3.70 - 6.86i$, which is option D.

A. $a \in [-270.5, -269]$ and $b \in [-7, -5.9]$

$-270.00 - 6.86i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [1.5, 3]$ and $b \in [-7.7, -7.25]$

$1.73 - 7.60i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-4.5, -3]$ and $b \in [-501.35, -500.4]$

$-3.70 - 501.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-4.5, -3]$ and $b \in [-7, -5.9]$

* $-3.70 - 6.86i$, which is the correct option.

E. $a \in [-2.5, 0]$ and $b \in [-22.35, -21.45]$

$-1.12 - 22.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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9. Simplify the expression below and choose the interval the simplification is contained within.

$$18 - 16^2 + 2 \div 8 * 14 \div 20$$

The solution is -237.825, which is option C.

A. $[-238.04, -237.96]$

-237.999, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[273.92, 274.05]$

274.001, which corresponds to two Order of Operations errors.

C. $[-237.85, -237.78]$

* -237.825, this is the correct option

D. $[274.15, 274.18]$

274.175, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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10. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-490}{0}}i + \sqrt{176}i$$

The solution is Not a Complex Number, which is option C.

A. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

B. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

C. Not a Complex Number

* This is the correct option!

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.
